Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1-42. (Cancelled).

43. (Currently Amended) An apparatus for producing a model of a combined system having physical quantities by representing physical quantities of the combined system in terms of partial differential equations, the apparatus comprising:

means for selecting an application mode modeling in up to three space dimensions the physical quantities for one or more of a plurality of systems, wherein the plurality of systems comprise at least one of a structural system, a fluids system, and an electromagnetic system;

means for receiving an input of one or more physical properties for each of the application modes;

means for determining a representation of a set of one or more partial differential equations for each application mode corresponding to one of the plurality of systems using at least one non-local coupling and the one or more input physical properties, the at least one non-local coupling defining a value from a first portion of a first domain to another ~~part~~ portion of a second domain; and

means for producing ~~a~~ the model of the ~~combination of~~ combined system by forming a combined set of one or more partial differential equations using the determined sets of partial differential equations associated with the plurality of systems, whereby the model represents a mathematical expression of the physical quantities of the combined physical system.

44. (Previously Presented) The apparatus of claim 43, wherein at least one of the determined sets of partial differential equation uses at least one local coupling.

45. (Previously Presented) The apparatus of claim 43, wherein the first and second domain are the same.

46. (Previously Presented) The apparatus of claim 43, wherein the first and second domain are different.

47. (Currently Amended) The apparatus of claim 43, further comprising:

means for defining a non-local coupling wherein a value of a quantity on a boundary of the first domain are referenced in defining parallel lines extending into the domain.

48. (Currently Amended) The apparatus of claim 43, further comprising:

means for defining a non-local coupling in which a boundary condition associated with the first domain is defined using a value of an integral over a portion of one of[[:]] the first domain and the second domain.

49. (Currently Amended) The apparatus of claim 43, further comprising:

means for defining a non-local coupling using at least one of[[:]] a mapped variable and an integrated variable.

50. (Currently Amended) The apparatus of claim 44, further comprising:

means for defining the local coupling using at least one of[[:]] a basic variable, an expression variable, and a glued variable.

51. (Currently Amended) The apparatus of claim 44, further comprising:

means for defining the non-local coupling variable using at least one of[[:]] an extrusion variable, a projection variable and a scalar variable.

52. (Previously Presented) The apparatus of claim 43, further comprising:

means for determining a stiffness matrix by determining a Jacobian of each variable in accordance with each type of variable wherein the combined set of partial differential equations is in weak form, the stiffness matrix being a Jacobian matrix formed from a residual vector with respect to a number of degrees of freedom; and

means for determining the residual vector by determining a Jacobian of each variable in accordance with each type of variable wherein the combined set of partial differential equations is in weak form.

53. (Currently Amended) The apparatus of claim 52, further comprising:

means for converting the combined set of partial differential equations from general form to weak form.

54. (Currently Amended) The apparatus of claim 53, wherein the means for determining the stiffness matrix further comprises:

means for determining values of a Jacobian of variables in accordance with points included in a quadrature formula and with other points in accordance with coupling variables.

55. (Previously Presented) The apparatus of claim 54, wherein the means for determining the residual vector further comprises means for determining values of variables and a Jacobian of the variables for node points and for other points in accordance with coupling variables.

56. (Currently Amended) The apparatus as set forth in claim 43 wherein the means for receiving an input further comprises means for receiving an input of one or more boundary conditions for each of the application modes, wherein the means for determining a representation of a set of one or more partial equations for each application mode corresponding to one of the plurality of systems also uses the one or more input boundary conditions.

57. (New) A computer system for producing a model of a combined system having physical quantities by representing physical quantities of the combined system in terms of partial differential equations, the model to be displayed on a display, comprising:

means for selecting an application mode modeling physical quantities for one or more of a plurality of systems;

means for receiving an input of one or more physical properties for each of the selected application modes;

means for determining a representation of a set of one or more partial differential equations for each application mode corresponding to one of the plurality of systems using at least one non-local coupling and the one or more input physical properties, the at least one non-local coupling defining a value from a first portion of a first domain to another portion of a second domain;

means for producing the model of the combined system by forming a combined set of one or more partial differential equations using the determined sets of partial differential equations associated with the plurality of systems, whereby the model represents a mathematical expression of the physical quantities of the combined physical system;

means for storing the model in a computer readable memory or in a computer readable data storage system connected to the computer system; and

means for outputting the model to a display connected to the computer system.

58. (New) The computer system of claim 57, wherein at least one of the determined sets of partial differential equation uses at least one local coupling.

59. (New) The computer system of claim 57, wherein the first and second domain are the same.

60. (New) The computer system of claim 57, wherein the first and second domain are different.

61. (New) The computer system of claim 57, further comprising:

means for defining a non-local coupling wherein a value of a quantity on a boundary of the first domain is referenced in defining parallel lines extending into the second domain.

62. (New) The computer system of claim 57, further comprising:

means for defining a non-local coupling in which a boundary condition associated with the first domain is defined using a value of an integral over a portion of one of the first domain and the second domain.

63. (New) The computer system of claim 57, further comprising:

means for defining a non-local coupling using at least one of a mapped variable and an integrated variable.

64. (New) The computer system of claim 58, further comprising:

means for defining a local coupling using at least one of a basic variable, an expression variable, and a glued variable.

65. (New) The computer system of claim 57, further comprising:

means for defining a non-local coupling using at least one of an extrusion variable, a projection variable, and a scalar variable.

66. (New) The computer system of claim 57, further comprising:

means for determining a stiffness matrix by determining a Jacobian of each variable in accordance with each type of variable wherein the combined set of partial differential equations is in weak form, the stiffness matrix being a Jacobian matrix formed from a residual vector with respect to a number of degrees of freedom; and

means for determining the residual vector by determining a Jacobian of each variable in accordance with each type of variable wherein the combined set of partial differential equations is in weak form.

67. (New) The computer system of claim 66, further comprising:

means for converting the combined set of partial differential equations from general form to weak form.

68. (New) The computer system of claim 67, wherein the means for determining the stiffness matrix further comprises:

means for determining values of a Jacobian of variables in accordance with points included in a quadrature formula and with other points in accordance with coupling variables.

69. (New) The computer system of claim 68, wherein the determining the residual vector further comprises:

means for determining values of variables and a Jacobian of the variables for node points and for other points in accordance with coupling variables.

70. (New) An apparatus for producing a model of a combined system having physical quantities by representing physical quantities of the combined system in terms of partial differential equations, the apparatus comprising:

a computer comprising a processor, a user input device, a display device, and a memory device, the memory device containing executable instructions for producing a model of a combined system having physical quantities by representing physical quantities of the combined system in terms of partial differential equations, the executable instructions causing the processor to perform, upon execution, acts comprising

selecting an application mode modeling in up to three space dimensions the physical quantities for one or more of a plurality of systems, wherein the systems include at least one of a structural system, a fluids system, and an electromagnetic system;

receiving an input of one or more physical properties for each of the application modes;

determining a representation of a set of one or more partial differential equations for each application mode corresponding to one of the plurality of systems using at least one non-local coupling and the one or more input physical properties, the at least one non-local coupling defining a value from a first portion of a first domain to another portion of a second domain;

producing the model of the combined system by forming a combined set of one or more partial differential equations using the determined sets of partial differential equations associated with the plurality of systems, whereby the model represents a mathematical expression of the physical quantities of the combined physical system; and

outputting the model to the display device.

71. (New) The apparatus of claim 70, wherein the executable instructions comprise a constraint for the producing of the model of the combined system, the constraint requiring that at least one of the determined sets of partial differential equation uses at least one local coupling.

72. (New) The apparatus of claim 70, wherein the executable instructions comprise a constraint for the producing of the model of the combined system, the constraint requiring that the first and second domain are the same.

73. (New) The apparatus of claim 70, wherein the executable instructions comprise a constraint for the producing of the model of the combined system, the constraint requiring that the first and second domain are different.

74. (New) The apparatus of claim 70, further comprising:

a definition system stored in the memory device or in another memory device in communication with the computer, the definition system comprising at least one of executable instructions and data defining a non-local coupling, wherein a value of a quantity on a boundary of the first domain is referenced in defining parallel lines extending into the second domain.

75. (New) The apparatus of claim 70, further comprising:

a definition system stored in the memory device or in another memory device in communication with the computer, the definition system comprising at least one of executable instructions and data defining a non-local coupling in which a boundary condition associated with the first domain is defined using a value of an integral over a portion of one of the first domain or the second domain.

76. (New) The apparatus of claim 70, further comprising:

a definition system stored in the memory device or in another memory device in communication with the computer, the definition system comprising at least one of executable instructions and data defining a non-local coupling using at least one of a mapped variable and an integrated variable.

77. (New) The apparatus of claim 71, further comprising:

a definition system stored in the memory device or in another memory device in communication with the computer, the definition system comprising at least one of executable instructions and data defining a local coupling using at least one of a basic variable, an expression variable, and a glued variable.

78. (New) The apparatus of claim 70, further comprising:

a definition system stored in the memory device or in another memory device in communication with the computer, the definition system comprising at least one of executable instructions and data defining a non-local coupling using at least one of an extrusion variable, a projection variable, and a scalar variable.

79. (New) The apparatus of claim 78, the memory device containing executable instructions for producing the model of the combined system, the executable instructions causing the processor to perform, upon execution, acts comprising:

determining a stiffness matrix by performing acts comprising determining a Jacobian of each variable in accordance with each type of variable.

80. (New) The apparatus of claim 79, the memory device containing executable instructions for producing the model of the combined system, the executable instructions causing the processor to perform, upon execution, acts further comprising:

converting the combined set of partial differential equations from general form to weak form.

81. (New) The apparatus of claim 80, the memory device containing executable instructions for producing the model of the combined system, the executable instructions causing the processor to perform, upon execution, acts further comprising:

determining values of a Jacobian of variables in accordance with points included in a quadrature formula and with other points in accordance with coupling variables.

82. (New) The apparatus of claim 81, the memory device containing executable instructions for producing the model of the combined system, the executable instructions causing the processor to perform, upon execution, acts further comprising:

determining values of variables and a Jacobian of the variables for node points and for other points in accordance with coupling variables.

83. (New) The apparatus of claim 70, wherein the memory device containing executable instructions for producing the model of the combined system, the executable instructions causing the processor to perform, upon execution, acts further comprising:

storing the model in the memory device or in a computer readable data storage system.

84. (New) A method executed in a computer system with at least one processor for producing a model of a combined physical system and a solution to the model, the method comprising:

representing a combined physical system by a geometry described by a mesh and a set of physical properties, the mesh including a plurality of elements, each of the elements being characterized by a shape;

providing a plurality of application modes;

selecting at least a first application mode from the plurality of application modes;

using the processor to generate a plurality of partial differential equations based on the first application mode, each of the partial differential equations representing a behavior of at least one physical quantity of the model in response to the set of physical properties;

non-locally coupling one or more of the plurality of partial differential equations, the step of non-locally coupling including providing a value from a portion of a first domain to another portion of a second domain;

using the processor and the plurality of partial differential equations to determine a solution comprising numerical values for the physical quantities on the node points in the mesh; and

storing in a computer readable memory or in a computer readable data storage system the solution to the model.

85. (New) A method executed in a computer system with at least one processor for producing a model of a combined physical system and a solution to the model in accord with claim 84, the method comprising:

producing a physical component corresponding to the mesh and the set of physical properties.

86. (New) An apparatus for producing a model of a combined system with physical quantities by representing said physical quantities of said combined system by partial differential equations, the apparatus comprising:

a computer comprising a processor, a user input device, a display device, and a memory device, the memory device containing executable instructions for producing a model of a combined system having physical quantities by representing physical quantities of the combined system in terms of partial differential equations, the executable instructions causing the processor to perform, upon execution, acts comprising

representing a combined physical system by a geometry described by a mesh and a set of physical properties, the mesh including a plurality of elements, each of the elements being characterized by a shape;

providing a plurality of application modes;

selecting at least a first application mode from the plurality of application modes;

using the processor to generate a plurality of partial differential equations based on the first application mode, each of the partial differential equations representing a

behavior of at least one physical quantity of the model in response to the set of physical properties;

non-locally coupling one or more of the plurality of partial differential equations, the step of non-locally coupling including providing a value from a portion of a first domain to another portion of a second domain;

using the processor and the plurality of partial differential equations to determine a solution comprising numerical values for the physical quantities on the node points in the mesh; and

storing in a computer readable memory or in a computer readable data storage system the solution to the model.